LEVEL-1 AND HLT FOR GAMMA+JET CALIBRATION

at low luminosity ($L = 2 \cdot 10^{33} \mathrm{cm}^{-2}\mathrm{s}^{-1}$)

Level-1:
We can use the single isolated electron/gamma trigger. The level-1 ET threshold of 23 GeV gives sufficient number of calibration events for gamma ET > 20 GeV.

HLT:
Single isolated gamma rate is dominated by QCD di-jet events and is too high.
Currently envisaged level-3 single gamma ET threshold is about 80 GeV.
We need a special trigger for gamma+jet events with the gamma transverse energy 20 GeV < ET < 80 GeV.

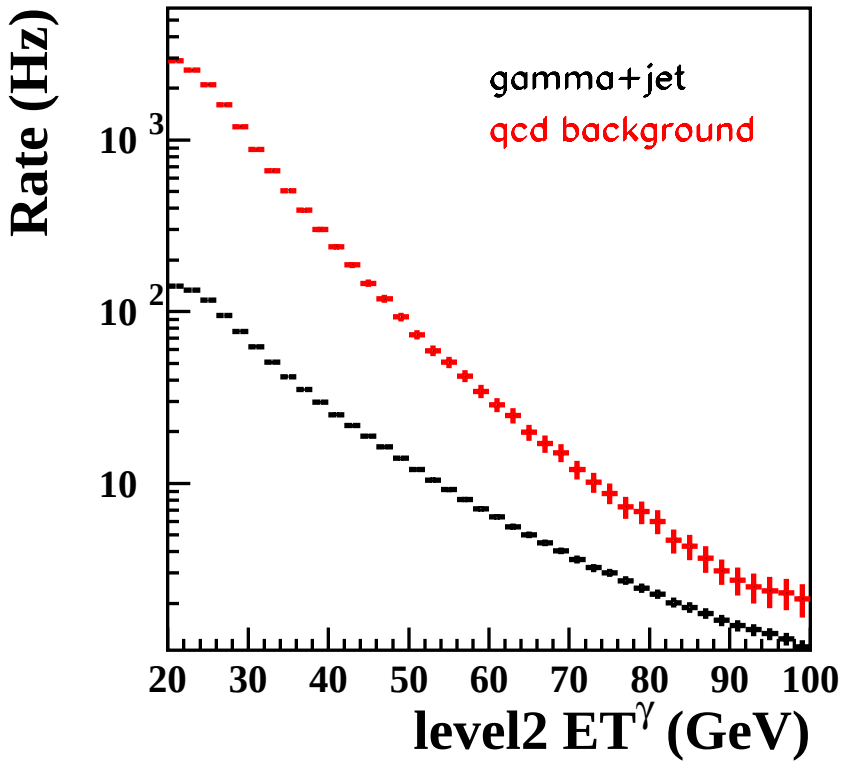
Gamma+jet calibration trigger

Since this trigger is proposed for a single purpose of the gamma+jet calibration,
it can directly implement most of the off-line selection algorithms.

Two groups of the off-line selections:
1) gamma isolation;
2) suppression of the initial and final state radiation (delta phi cut, second jet veto etc.)
The second group selections are able to cause a systematic bias in the energy calibration
and we should prefer to reserve them for off-line analysis.

Thus the gamma+jet calibration trigger should be a single isolated gamma trigger
but it is bound to have low efficiency because of extremely high signal and background
rates.

Level-2 single isolated electron/gamma rates with ORCA 6



Level-2 isolated gamma rate is dominated by QCD jet events and is to be reduced by a factor of ~1000 for offline storage.

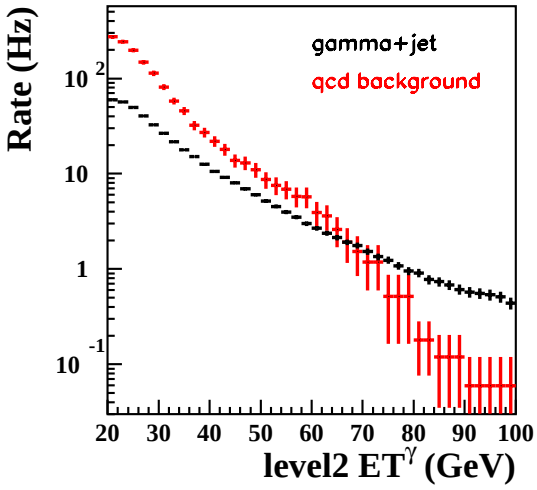
Additional strong (low efficiency) gamma isolation cuts can be used in HLT to improve the calibration sample purity without any loss in the amount of the offline data.

QCD EVENTS SUPPRESSION WITH ADDITIONAL GAMMA ISOLATION

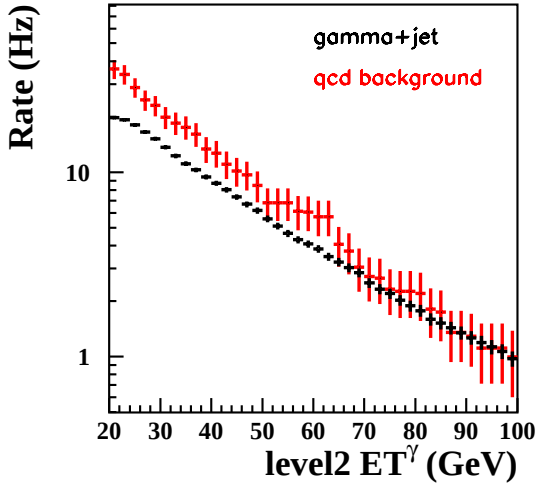
1) Pixel isolation: no pixel line from the signal vertex in the cone R= 0.7 around the level-2 gamma direction. The signal vertex is reconstructed as the vertex with a highest pixel line PT sum.

2) ECAL isolation: Sum of ECAL hits with ET> 0.1 GeV in the region 0.07< dR< 0.5 around the level-2 gamma direction is required to be less than $0.005\left(E_T^{\gamma}\right)^{1.5}$

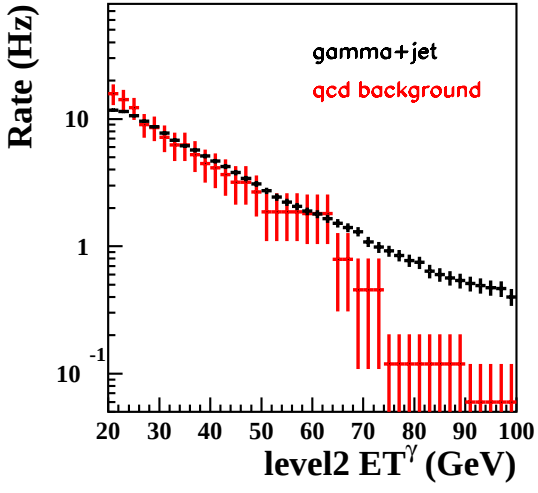
pixel isolation



ECAL isolation

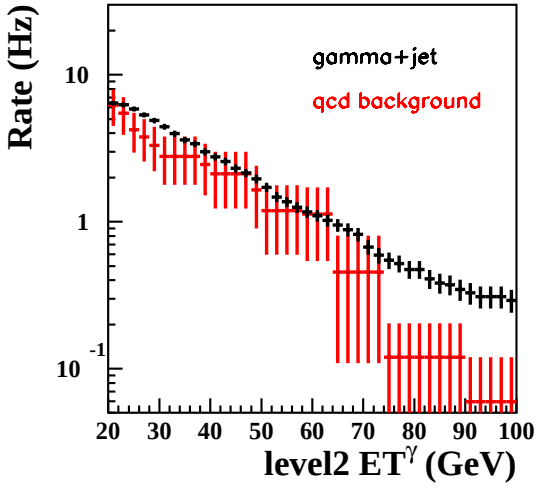


pixel+ECAL isolation

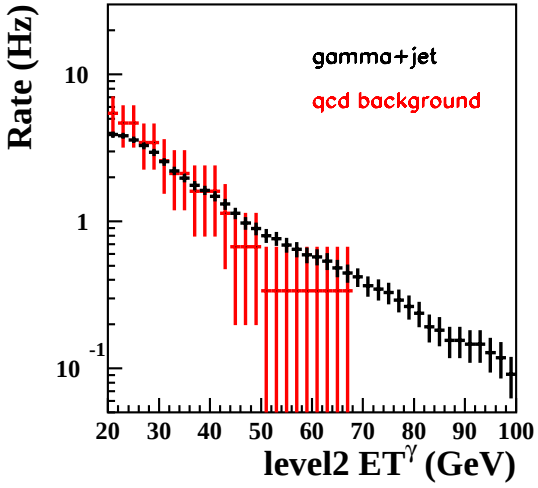


RATES AFTER PIXEL+ECAL ISOLATION
depending on the leading jet pseudorapidity region

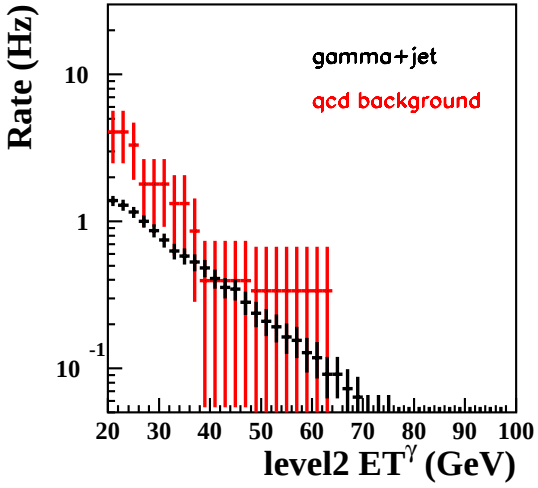
ETAjet < 1.5



1.5 < ETAjet < 3

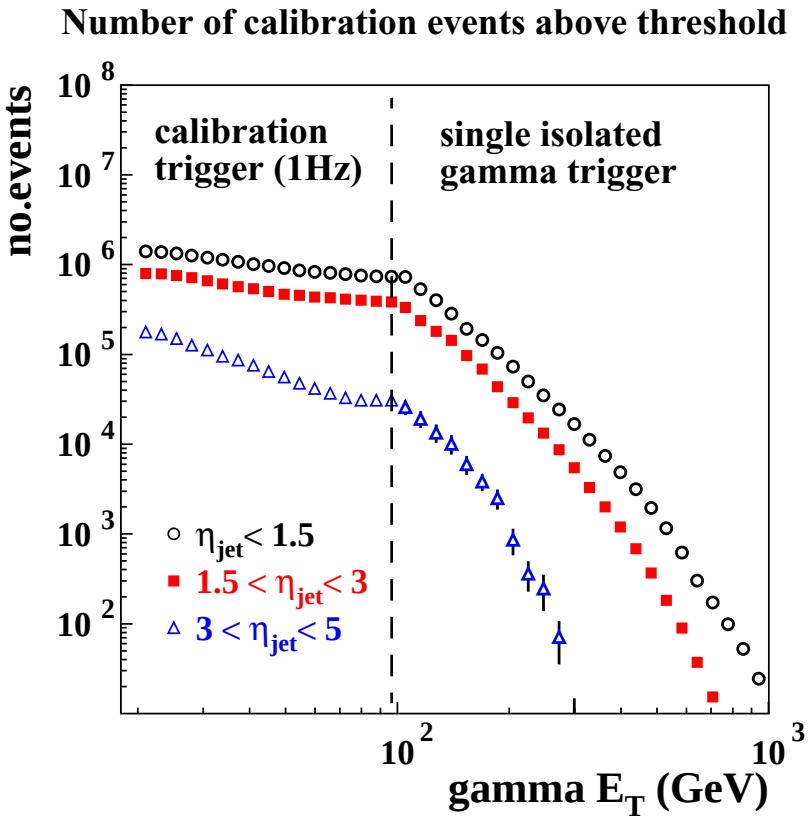


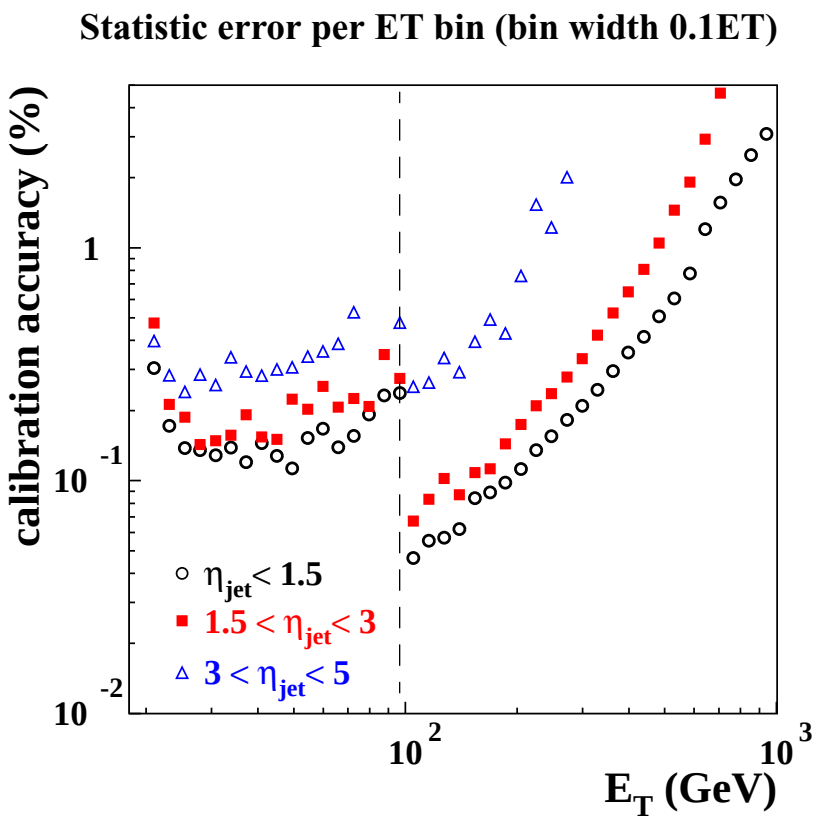
3 < ETAjet



No significant improvement in the signal/background is seen with further isolation.
Then simple prescaling can be used to bring the rates down to affordable level.

NUMBER OF EVENTS AND JET ENERGY CALIBRATION ACCURACY
after 3 months of data taking





Assuming 50% off-line selection efficiency after the calibration trigger and 30% off-line efficiency after the "efficient" single isolated gamma trigger

CALIBRATION TRIGGRER AND ELECTRON/GAMMA TRIGGER